

## PATENT ABSTRACTS OF JAPAN

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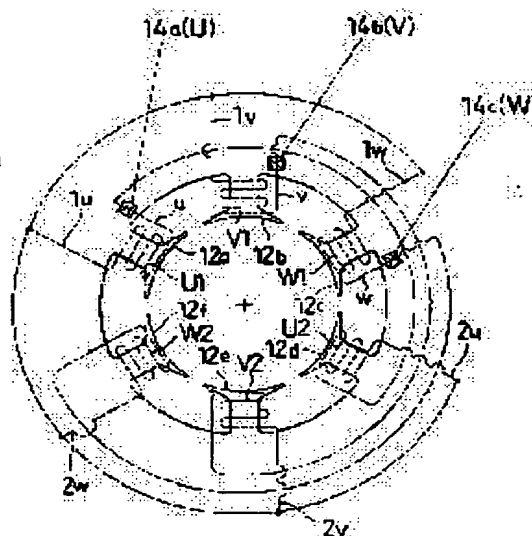
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## (54) PARALLEL CONNECTION METHOD FOR STATOR COIL AND ITS STATOR

(57)Abstract:

**PROBLEM TO BE SOLVED:** To perform a parallel connection using less number of lead wires than usual and automate the connection.

**SOLUTION:** Among a plurality of pole teeth 12a to 12f of a stator core 11, the adjoining three pole teeth 12a, 12b and 12c are started to be wound with first coils U1, V1 and W1 from respective neutral lines, and sequentially opposing pole teeth 12d, 12e and 12f are wound with lead wires u, v and w of the first coils U1, V1 and W1 via single terminals 14a, 14b and 14c of an insulating frame, to form second coils U2, V2 and W2. Power lines having U, V and W phases are connected to the single terminals 14a, 14b and 14c, and the neutral line in starting the windings of the first coils U1, V1 and W1 and the neutral line in completing the windings of the second coils U2, V2 and W2 are connected to a triple terminal of the insulating frame.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] It is the parallel-connection approach of the stator coil of the three-phase-circuit star connection which carries out a coil to two or more magnetic pole gear teeth of a stator core through an insulating frame. While connecting to the power-source line of a three phase circuit the crossover to the 2nd coil which carries out phase opposite among said two or more magnetic pole gear teeth, and carries out the coil of the 1st coil which carries out a coil to a magnetic pole gear tooth to a cut water and the magnetic pole gear tooth of another side from the neutral line, respectively, respectively The parallel-connection approach of the stator coil characterized by for the neutral line and the 2nd coil of the cut water of the 1st coil winding, and connecting the neutral line of an end mutually.

[Claim 2] The parallel-connection approach of the stator coil according to claim 1 characterized by connecting the crossover from the 1st coil to the 2nd coil to the power-source line of a three phase circuit through an insulating frame and the terminal of one, respectively.

[Claim 3] The parallel-connection approach of the stator coil according to claim 2 characterized by making it cross to the coil slot which carries out phase opposite along with the guide which led to the field by the side of this terminal, and the field of the opposite side, and was prepared in said insulating frame after depositing the crossover from the 1st coil to the 2nd coil with the terminal of an insulating frame.

[Claim 4] In the stator which carried out the coil of the stator coil of three-phase-circuit star connection to the stator core which has two or more magnetic pole gear teeth arranged at equal intervals at the inner circumference section through the insulating frame The stator characterized by preparing three terminals for power-source lines which constitute each phase of said stator from the 1st coil and 2nd coil by which the parallel connection was carried out, and deposit the crossover between the said 1st and 2nd coil with one field of said insulating frame.

[Claim 5] An insulating frame is a stator according to claim 4 characterized by preparing the terminal for the neutral lines which the cut-water line of said 1st coil and said 2nd coil wind, and connects an end line to the terminal side for power-source lines which deposits the crossover between the 1st and 2nd coil.

[Claim 6] An insulating frame is a stator according to claim 5 characterized by preparing the guide section which makes the crossover of the power-source line between each coil cross to the field of the terminal for power-source lines and the opposite side with which the crossover between the 1st and 2nd coil is deposited, without contacting, respectively.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention relates to the stator which has the coil by which connection was carried out by the parallel-connection approach of the stator coil of the three-phase-circuit star connection by which the coil was carried out to two or more magnetic pole gear teeth, and its parallel-connection approach.

**[0002]**

**[Description of the Prior Art]** Generally, as for many of three-phase-circuit motors, star connection is used. In this case, the coil of two or more poles by which parallel connection was carried out mutually needs to constitute each phase of a stator from the motor of the high current of which big power is required. Drawing 10 shows the schematics of the conventional stator coil. The stator 10 of three-phase-circuit 6 pole has the magnetic pole gear teeth 12a-12f of six poles arranged at equal intervals at the inner circumference section of a stator core 11. For these magnetic pole gear teeth 12a-12f Through the insulating frame (not shown) which has two or more terminal areas, the stator coil (only henceforth a "coil") U1 by which connection was carried out to juxtaposition of every a pair for every U phase, V phase, and W phase, respectively, U2;V1, V2;W1, and W2 carry out phase opposite, and the coil is carried out. And after the coil U1 of these six poles, U2;V1, V2;W1, and W2 winding and depositing neutral-line (lead wire) 1u of an end, 2u;1v, 2v;1w, and 2w with each terminal area of the above-mentioned insulating frame, the neutral point of three-phase-circuit star connection is formed by connecting mutually by welding or soldering.

**[0003]**

**[Problem(s) to be Solved by the Invention]** However, if it is in the parallel-connection approach and stator of such a conventional stator coil, when performing a parallel connection, for example by the stator of three-phase-circuit 6 pole, connection of every two power-source lines was needed with connection of the six neutral lines, respectively, and the twice as many terminal as this and the connection man day were required as compared with the case of serial connection. It was difficult to make connection of the neutral line and connection of a power-source line in respect of [ of an insulating frame ] the same, and since contacting mutually was not desirable at this time as for the power-source line of each phases U, V, and W, after preparing the terminal in both sides of an insulating frame, respectively, the circuit board etc. was needed separately, and while automation of connection became remarkably difficult, there was a trouble that a production cost went up. This invention is made in view of the above-mentioned point, and it aims at offering the parallel-connection approach of the optimal stator coil for the automation in which the parallel connection of a stator coil is possible, and its stator by connection of lead-wire comrades fewer than before.

**[0004]**

**[Means for Solving the Problem]** In order that this invention may attain the above-mentioned purpose, it is the parallel-connection approach of the stator coil of the three-phase-circuit star connection which carries out a coil to two or more magnetic pole gear teeth of a stator core through an insulating frame. While connecting to the power-source line of a three phase circuit the crossover to the 2nd coil which carries out phase opposite among two or more above-mentioned magnetic pole gear teeth, and carries out the coil of the 1st coil which carries out a coil to a magnetic pole gear tooth to a cut water and the magnetic pole gear tooth of another side from the neutral line, respectively, respectively The parallel-connection approach of the stator coil which the neutral line and the 2nd coil of the cut water of the 1st coil wind, and connects the neutral line of an end mutually is offered. And are good to connect the crossover from the 1st coil to the 2nd coil to the power-source line of a three phase circuit through an insulating frame and the terminal of one in the parallel-connection approach of the above-mentioned stator coil, respectively. Moreover, after depositing the crossover from the 1st coil to the 2nd coil with the terminal of an insulating frame, it is still better to make it make it cross to the coil slot which carries out phase opposite along with the guide which led to the field by the side of this terminal, and the field of the opposite side, and was prepared in the above-mentioned insulating frame.

**[0005]** Moreover, it sets to the stator which carried out the coil of the stator coil of three-phase-circuit star connection to the stator core which has two or more magnetic pole gear teeth arranged at equal intervals at the inner circumference section through the insulating frame. Each phase of the above-mentioned stator is constituted from the 1st coil and 2nd coil by which connection was carried out to juxtaposition, and the stator which prepared three terminals for power-source lines which deposit the crossover between the above 1st and the 2nd coil with one field of the above-mentioned insulating frame is also offered. In the above-mentioned stator, an insulating frame to and the terminal side for power-source lines which deposits the crossover between the 1st and 2nd coil Are good

to prepare the terminal for the neutral lines which the cut-water line of the 1st coil of the above and the 2nd coil of the above wind, and connects an end line. Further an insulating frame It is still better to prepare the guide section which makes the crossover of the power-source line between each coil cross to the field of the terminal for power sources and the opposite side with which the crossover between the 1st and 2nd coil is deposited, without contacting, respectively.

[0006] By constituting as mentioned above, in the parallel-connection approach of that stator coil, this invention can omit the line processing after the coil coil of the power-source line of each phase, and can perform a parallel connection by processing of a lead wire fewer than before. Moreover, the stator by which connection was carried out by the above parallel-connection approaches While making automation of connection easy by preparing the terminal for power-source lines, and the terminal for the neutral lines in one field of an insulating frame By preparing the guide section of the crossover of each power-source line in each above-mentioned terminal and the field of the opposite side, a small tooth space can be used effectively, and the circuit board needed by the conventional parallel connection is not needed, but the production cost reduction of a stator becomes possible.

[0007]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is concretely explained based on a drawing. The sectional side elevation in which the typical schematics with which the schematics in which drawing 1 shows 1 operation gestalt of this invention, and drawing 2 simplified drawing 1, drawing 3, or drawing 6 shows the stator by which the coil was carried out in the coil, that top view and drawing 4 showed the part with that rear view, and drawing 3 showed drawing 5 in the A-A cross section of drawing 3, and drawing 6 are the important section side elevations showing the crossover of that power-source line. In addition, in these drawings, the same sign is attached and shown in the part corresponding to drawing 10, and the explanation is omitted. The stator core 11 which has the magnetic pole gear teeth 12a, 12b, 12c, 12d, 12e, and 12f (it is called "the magnetic pole gear tooth 12" when the thing of arbitration is shown) of six poles arranged 60 degrees from the core at spacing at the inner circumference section as this stator 10 is shown in drawing 3 - drawing 5. An each coil slots [ of this stator core 11 / 13a-13f ] inside is covered. It protrudes on an end side in three single string terminals 14a, 14b, and 14c and 14d of one 3 ream terminal, and consists of an insulating frame 14 which formed the guide slots 14e, 14f, and 14g of three articles as the guide section of a crossover in the periphery section of an other end side, respectively.

[0008] To the single string terminals 14a and 14b of a stator 10 which consist of such a configuration, and adjacency \*\*\*\*\* 12a, 12b, and 12c by the side of 14c For example, after depositing each lead wire u, v, and w of the 1st coil U1, V1, and W1 of the three phase circuit which carried out the coil to coincidence with the nozzle direct volume winding machine, respectively in the slit of the single string terminals 14a, 14b, and 14c shown in drawing 3, The crossover to each magnetic pole gear tooth which carries out phase opposite to the coil slots 13d, 13e, and 13f which lead to the field of the opposite side shown in drawing 4, without cutting, and carry out phase opposite respectively along the guide slots 14e, 14f, and 14g of the periphery section Delivery, A coil is performed succeeding the magnetic pole gear teeth 12d, 12e, and 12f, and the 2nd coil U2, V2, and W2 is formed. As shown in drawing 3 and drawing 4 after a coil Arbitration deposits with the slit of 14d of 3 ream terminals (or 6 ream terminal) two (1 [ or ]) every using the line processing robot which the neutral lines 1u, 1v, and 1w and the 2nd coil U2, V2, and W2 of the cut water of the 1st coil U1, V1, and W1 wind, and mentions the neutral lines 2u, 2v, and 2w of an end later. While connecting each power supply terminal of U phase, V phase, and W phase to three single string terminals 14a, 14b, and 14c formed in the same side of the insulating frame 14 By inserting a solderless terminal (not shown) in 14d of one 3 ream terminal, all the neutral lines 1u, 1v, 1w, 2u, 2v, and 2w are connected, and the neutral point is formed.

[0009] Drawing 1 and drawing 2 show the schematics of the above-mentioned stator. As shown in these schematics, with this operation gestalt It is begun conventionally to coil the coil coil which it is beginning to coil from each power-source line of U phase, V phase, and W phase from the neutral line, respectively. Line processing of each power-source line after a coil is omissible by making three single string terminals which prepared the crossover of the 1st and 2nd coil U1 which carries out phase opposite, U2;V1, V2;W1, and W2 in the insulating frame intercede, and connecting the power source of U phase, V phase, and W phase to each single string terminal. Moreover, since it leads to the field of the opposite side, it dissociates with the neutral line and it was made to perform the passage of a power-source line after depositing the lead wire of the 1st coil U1, V1, and W1 by which the coil was carried out to coincidence in the slit of the terminal for power-source line connection Automation of connection becomes easy while becoming possible to prevent contact of each power-source line in a small tooth space, and to be able to make connection of the neutral line and connection of a power-source line only in respect of one side of a stator, without using the circuit board etc., and for the configuration of an insulating frame to become easy, and to use an established thing. In addition, when a tooth space is in the terminal side of an insulating frame, it does not necessarily need to lead the crossover of a power-source line to the opposite side.

[0010] The front view in which drawing 7 shows the above-mentioned line processing robot's outline, and drawing 8 are the top views showing only the important section. That right and left, order, the upper and lower sides, and revolution are free for this line processing robot 20, and the hand 21 which releases [ grasping and ] the lead wire 30 of each coil, With the wire pusher 22 who stuffs into the slit of 14d of each terminal, for example, 3 ream terminal, the lead wire 30 grasped by the hand 21 It has the nipper 23 of the pushed-in lead wire which cuts a line not much, and the line keeping guide 24 ( drawing 8 ) to which it shows the time of depositing each lead wire in the slit of each terminal by these. With such a configuration, it sets to the line processing location which defined the stator 10 beforehand, and while advancing the location which shows the line keeping guide 24 as a continuous line from the

location shown in drawing 8 by the imaginary line, it winds with the lead wire 1u, 1v, and 1w which a hand 21 tends to process, for example, the neutral lines of a cut water, and the last neutral lines 2u, 2v, and 2w are grasped, respectively. Next, 14d of terminals which the line processing robot 20 tends to be operated and are going to deposit each lead wire, for example, 3 ream terminal, is conveyed, every two of arbitration are stuffed into three slits with the wire pusher 22, respectively, and a nipper 23 cuts a line not much.

[0011] Although the case of the stator of three-layer six poles was explained in the above operation gestalt, drawing 9 is the schematics showing other operation gestalten which carried out this invention to the stator of three-phase-circuit 9 pole. In addition, although only the coil of U phase is illustrated in order to make drawing intelligible in this drawing 9, in addition to this, 2 sets (they are 3 sets at all) of coils, V phase and W phase, by which connection was carried out similarly exist in fact. The fixed iron core 41 which has the magnetic pole gear teeth 42a, 42b, 42c, 42d, 42e, 42f, 42g, 42h, and 42i of nine poles where this stator 40 has been arranged 40 degrees from the core at spacing at the inner circumference section. It has the insulating frame (neither is illustrated) which has a pre-operation gestalt, three same single string terminals ( drawing 9 shows only one terminal 44a of them), and one multiple-string terminal in the same field side. For the above-mentioned magnetic pole gear teeth 42a, 42d, and 42g, respectively and the 1st, 2nd, and 3rd coil U1, U2, and U3 of U phase The 1st, 2nd, and 3rd coil V1, V2, and V3 of V phase was made the magnetic pole gear teeth 42b, 42e, and 42h, the coil of the 1st, 2nd, and 3rd coil W1 and W2 of W phase and W3 was made to the magnetic pole gear teeth 42c, 42f, and 42i, respectively, and the coil of each phase is connected to juxtaposition.

[0012] On the occasion of the coil of each coil, each begins to wind the 1st coil U1, V1, and W1 of a three phase circuit around the magnetic pole gear teeth 42a, 42b, and 42c from the neutral line like a pre-operation gestalt at coincidence. Although only U phase is explained, after carrying out several predetermined turn line of the 1st coil U1, wind, the slit of single string terminal 44a which was made to cross clockwise neutral-line 1u of a cut water and the field of the opposite side, and formed the end line in the neutral-line 1u side is made to straddle, the coil of the 2nd coil U2 is carried out to 42d of magnetic pole gear teeth, to a neutral-line side, predetermined carries out the die-length drawer henceforth of, and it cuts the terminal line 2u. Subsequently, after depositing cut-water line 3u of the 3rd coil which consists of a new wire to the slit of the above-mentioned single string terminal 44a, a terminal side and the field of the opposite side are made to cross clockwise, several predetermined turn line of the 3rd coil U3 is carried out to 42g of magnetic pole gear teeth, to a neutral-line side, predetermined carries out the die-length drawer of terminal line 3u' of the volume end, and it is cut.

[0013] Ranging over the slit of the same 2nd [ the / as drawing 1 which similarly the 1st coil V1 and W1 of V phase and W phase winds, and does not illustrate an end line ], and 3rd single string terminal, the coil of the 2nd coil V2 and W2 is carried out to the magnetic pole gear teeth 42d and 42f, respectively, predetermined die length is pulled out and the terminal line in the end of a volume is cut, respectively. Furthermore, after depositing with the 2nd and 3rd single string terminal the 3rd coil V3 and the cut-water line of W3 which consist of a new wire, the coil of the 3rd coil V3 of V phase and W phase and W3 is carried out to the magnetic pole gear teeth 42h and 42i, respectively, predetermined carries out the die-length drawer of the terminal line after a coil, and it is cut. Finally, while connecting each power supply terminal of U phase, V phase, and W phase to the 1st, 2nd, and 3rd single string terminal All the neutral lines are connected by the cut-water line of the 1st coil U1, V1, and W1, the 2nd and 3rd coil U2, V2;U3, and W3 winding around the multiple-string terminal prepared in the same field side as the above-mentioned single string terminal, depositing with two or more end lines at a time, and inserting a solderless terminal in the above-mentioned multiple-string terminal. Therefore, with this operation gestalt, only the 3rd coil U3 and V3 and W3 will begin to be rolled from a power-source line. In addition, in the case of the stator of three-phase-circuit 12 pole, the coil pattern of the three-phase-circuit 6 above-mentioned pole can be shifted to a hand of cut 30 degrees, it prepares a power supply terminal superposition, U phase, V phase, and each two W phases at a time, and it becomes possible by connecting every two power supply terminals of these with power-source line connection too hastily to carry out parallel connection of the four coils.

[0014]

[Effect of the Invention] As stated above, according to this invention, the effectiveness indicated below is done so. According to the parallel-connection approach of a stator coil according to claim 1, since the crossover to the 2nd coil which carries out the coil of the 1st coil of each magnetic pole gear tooth of a stator in which while carries out phase opposite, and which carries out a coil to a magnetic pole gear tooth to a cut water and the magnetic pole gear tooth of another side from the neutral line, respectively was connected to the power-source line of a three phase circuit, respectively, the line processing after the coil of a power-source line can be excluded, and it becomes possible to perform a parallel connection by processing of little lead wire. According to the parallel-connection approach of a stator coil according to claim 2, since the crossover from the 1st coil to the 2nd coil was connected to the power-source line of a three phase circuit through the terminal of an insulating frame, respectively, connection with a power-source line can be simplified sharply. According to the parallel-connection approach of a stator coil according to claim 3, since it was made to make it go across the crossover of the power-source line between the 1st and 2nd coil along with a terminal and the guide of the opposite side, a possibility that it may become complicated with each neutral line, and a power-source line comrade may contact mutually disappears.

[0015] Since the terminal for power-source lines which deposits the crossover between the 1st and 2nd coil with one field of an insulating frame was prepared according to the stator according to claim 4, it becomes possible to connect the power-source line of a three phase circuit to these terminals for power-source lines by one-touch. According to the stator according to claim 5, since the terminal for the neutral lines was prepared in the same field

as the terminal for power sources of an insulating frame, connection of each lead wire requires only one field side of a stator, and automation of the line processing by a line processing robot etc. becomes easy. Since it was made to make it go across the guide section which formed the power-source line between the 1st and 2nd coil in the terminal of an insulating frame, and the field of the opposite side according to the stator according to claim 6, there is no possibility that the comrade between power-source lines may contact, the circuit board etc. is not needed but the miniaturization of a stator and reduction of a production cost are attained.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] They are the schematics showing 1 operation gestalt of this invention.

[Drawing 2] They are the typical schematics which simplified drawing 1 .

[Drawing 3] It is the top view showing the stator by this invention with a stator coil.

[Drawing 4] Similarly it is the rear view.

[Drawing 5] It is the sectional side elevation having shown the part similarly in the A-A cross section of drawing 3 .

[Drawing 6] It is the important section side elevation showing the crossover of the power-source line similarly.

[Drawing 7] It is the front view showing the outline of the line processing robot used for the parallel connection of this invention.

[Drawing 8] It is the top view showing only the important section similarly.

[Drawing 9] They are the schematics showing only U phase of other operation gestalten of this invention.

[Drawing 10] They are the schematics of the parallel connection of the conventional stator coil.

[Description of Notations]

1u, 1v, 1w: The cut-water line of the 1st coil (neutral line)

2u, 2v, 2w: The 2nd coil winds and it is an end line (neutral line).

3u: The cut-water line of the 3rd coil

3u': The 3rd coil winds and it is an end line.

10 40: Stator 11 41: Stator core

12, 12a-12f, 42a-42i: Magnetic pole gear tooth

13a-13f: Coil slot

14: Insulating frame

14a-14c, 44a: Single string terminal 14d:3 ream terminal

14e-14g: Guide slot

20: Line processing robot 21: Hand

22: Wire pusher 23: Nipper

30: Lead wire

U1, V1, W1: The 1st coil

U2, V2, W2: The 2nd coil

U3, V3, W3: The 3rd coil

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[Translation done.]

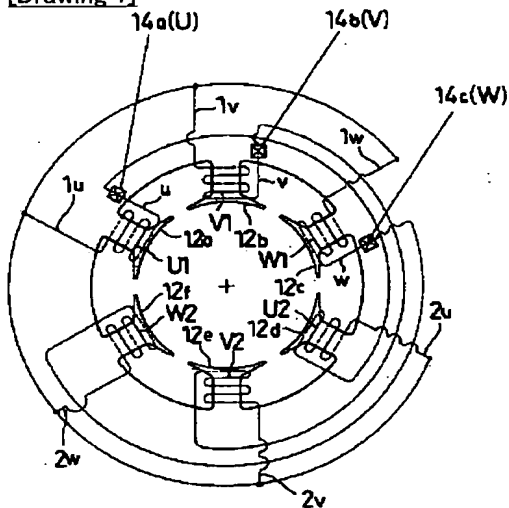
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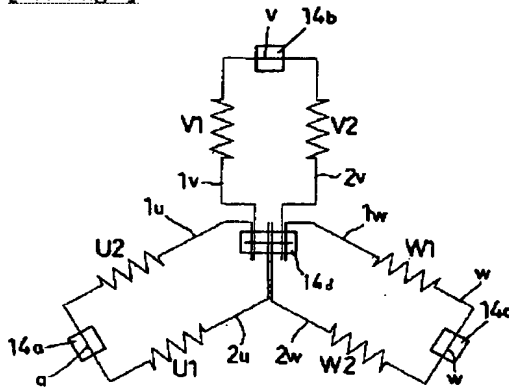
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## DRAWINGS

[Drawing 1]

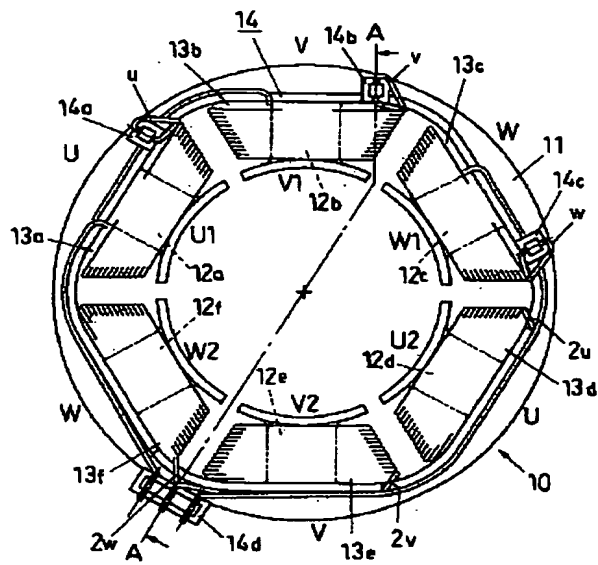


[Drawing 2]

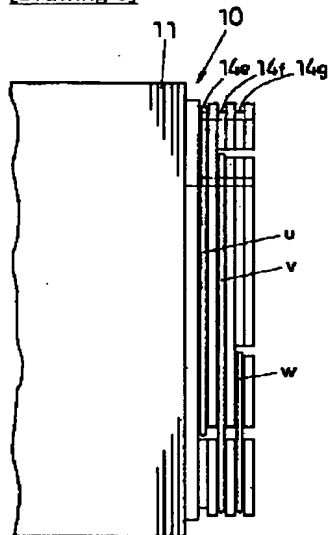


[Drawing 3]

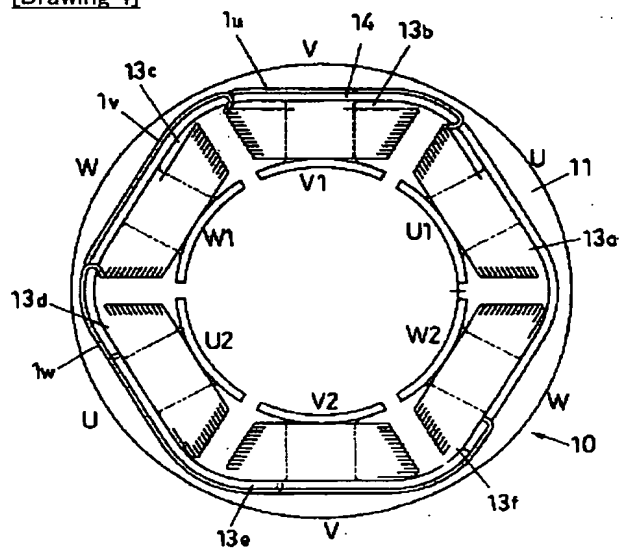




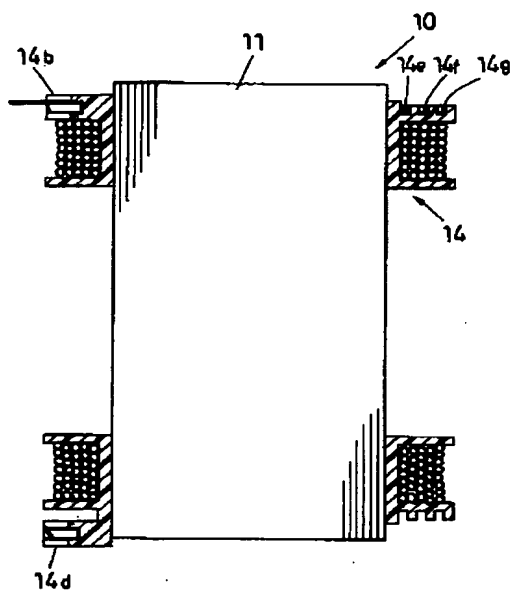
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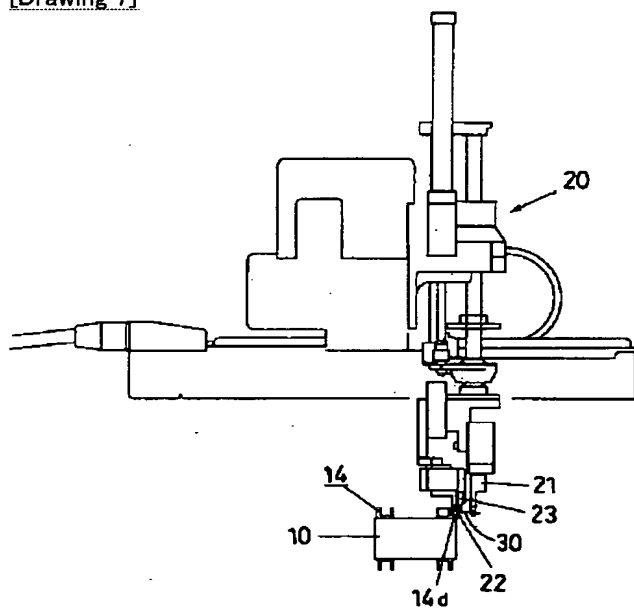
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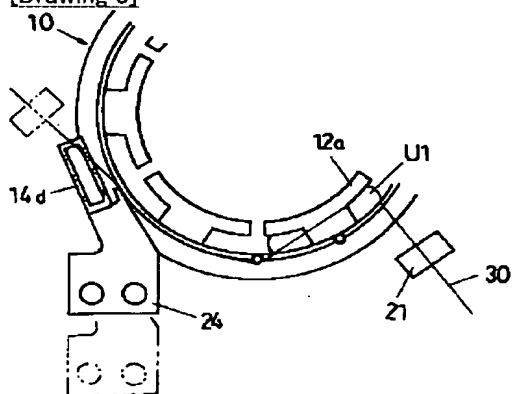
[Drawing 5]



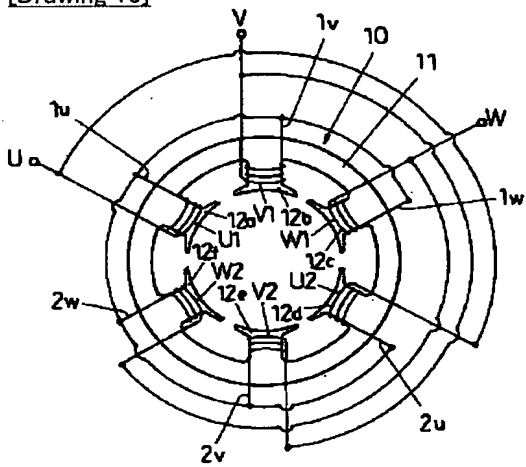
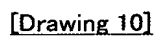
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]

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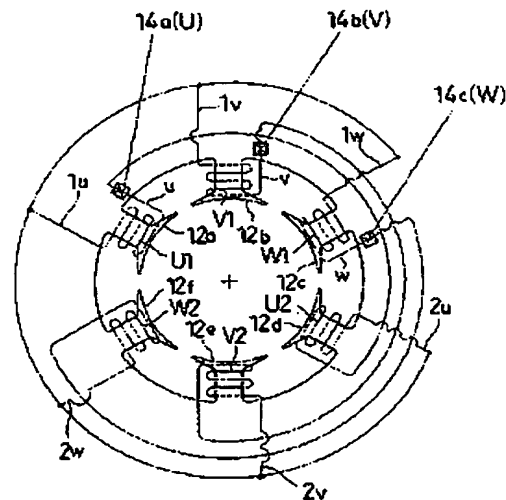
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(54) 【発明の名称】 固定子コイルの並列結線方法とその固定子

(57) 【要約】

【課題】従来より少ないリード線の処理で並列結線を行い、自動化を図る。

【解決手段】固定子鉄心11の複数の磁極歯12a～12fのうち、相隣る3本の磁極歯12a、12b、12cに第1のコイルU1、V1、W1をそれぞれ中性線から巻き始め、上記第1のコイルU1、V1、W1のリード線u、v、wを絶縁枠の単連端子14a、14b、14cを介し連続して相対向する磁極歯12d、12e、12fへ巻線して第2のコイルU2、V2、W2を形成する。単連端子14a、14b、14cにU相、V相、W相の電源線を接続するとともに、第1のコイルU1、V1、W1の巻き始めの中性線と第2のコイルU2、V2、W2の巻き終わりの中性線を上記絶縁枠の3連端子に連結する。



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【特許請求の範囲】

【請求項1】 固定子鉄心の複数の磁極歯に絶縁棒を介して巻線する3相星形結線の固定子コイルの並列結線方法であって、

前記複数の磁極歯のうち、相対向する一方の磁極歯に巻線する第1のコイルをそれぞれ中性線から巻き始め、他方の磁極歯に巻線する第2のコイルへの渡り線を3相の電源線にそれぞれ接続するとともに、第1のコイルの巻き始めの中性線と第2のコイルの巻き終わりの中性線とを互いに接続することを特徴とする固定子コイルの並列結線方法。

【請求項2】 第1のコイルから第2のコイルへの渡り線を絶縁棒と一体の端子を介してそれぞれ3相の電源線に接続することを特徴とする請求項1記載の固定子コイルの並列結線方法。

【請求項3】 第1のコイルから第2のコイルへの渡り線を絶縁棒の端子に預けた後、該端子側の面と反対側の面に導いて前記絶縁棒に設けたガイドに沿って相対向する巻線スロットへ渡らせることを特徴とする請求項2記載の固定子コイルの並列結線方法。

【請求項4】 内周部に等間隔に配置された複数の磁極歯を有する固定子鉄心に、絶縁棒を介して3相星形結線の固定子コイルを巻線した固定子において、前記固定子の各相を互いに並列結線された第1のコイルと第2のコイルで構成し、前記絶縁棒の一方の面に前記第1、第2のコイル間の渡り線を預ける3個の電源線用端子を設けたことを特徴とする固定子。

【請求項5】 絶縁棒は、第1、第2のコイル間の渡り線を預ける電源線用端子側に、前記第1のコイルの巻き始め線と前記第2のコイルの巻き終わり線とを接続する中性線用端子を設けたことを特徴とする請求項4記載の固定子。

【請求項6】 絶縁棒は、第1、第2のコイル間の渡り線を預ける電源線用端子と反対側の面に、各コイル間の電源線の渡り線をそれぞれ接触することなく渡らせるガイド部を設けたことを特徴とする請求項5記載の固定子。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、複数の磁極歯に巻線された3相星形結線の固定子コイルの並列結線方法及びその並列結線方法により結線されたコイルを有する固定子に関する。

【0002】

【従来の技術】一般に、3相電動機の多くは星形結線が用いられている。この場合、大きなパワーを要求される大電流の電動機では、固定子の各相を互いに並列接続された複数極のコイルで構成する必要がある。図10は、従来の固定子コイルの結線図を示すものである。3相6極の固定子10は、固定子鉄心11の内周部に等間隔に

配置された6極の磁極歯12a～12fを有し、これらの磁極歯12a～12fには、複数の端子部を有する絶縁棒（図示しない）を介して、U相、V相、W相毎にそれぞれ一対ずつの並列に結線された固定子コイル（以下単に「コイル」という）U1、U2；V1、V2；W1、W2が相対向して巻線されている。そして、これらの6極のコイルU1、U2；V1、V2；W1、W2の巻き終わりの中性線（リード線）1u、2u；1v、2v；1w、2wを上記の絶縁棒の各端子部に預けた後、溶接又は半田付け等により互いに接続することにより、3相星形結線の中性点を形成している。

【0003】

【発明が解決しようとする課題】しかしながら、このような従来の固定子コイルの並列結線方法とその固定子にあっては、例えば3相6極の固定子で並列結線を行う場合、6本の中性線の接続とそれぞれ2本ずつの電源線の接続とが必要となり、直列結線の場合と比較して2倍の端子と接続工数が必要であった。このとき、各相U、V、Wの電源線は互いに接触することが好ましくないため、中性線の接続と電源線の接続とを絶縁棒の同一面で行うことが難しく、絶縁棒の両面にそれぞれ端子を設けた上、別途に回路基板等を必要とし、結線の自動化が著しく困難になると同時に生産コストが上昇するという問題点があった。この発明は上記の点に鑑みてなされたものであり、従来より少ないリード線同志の接続で固定子コイルの並列結線が可能な自動化に最適な固定子コイルの並列結線方法及びその固定子を提供することを目的とする。

【0004】

【課題を解決するための手段】この発明は上記の目的を達成するため、固定子鉄心の複数の磁極歯に絶縁棒を介して巻線する3相星形結線の固定子コイルの並列結線方法であって、上記複数の磁極歯のうち、相対向する一方の磁極歯に巻線する第1のコイルをそれぞれ中性線から巻き始め、他方の磁極歯に巻線する第2のコイルへの渡り線を3相の電源線にそれぞれ接続するとともに、第1のコイルの巻き始めの中性線と第2のコイルの巻き終わりの中性線を互いに接続する固定子コイルの並列結線方法を提供するものである。そして、上記の固定子コイルの並列結線方法において、第1のコイルから第2のコイルへの渡り線を絶縁棒と一体の端子を介してそれぞれ3相の電源線に接続するのがよく、また、第1のコイルから第2のコイルへの渡り線を絶縁棒の端子に預けた後、この端子側の面と反対側の面に導いて上記絶縁棒に設けたガイドに沿って相対向する巻線スロットへ渡らせるようにするとさらによい。

【0005】また、内周部に等間隔に配置された複数の磁極歯を有する固定子鉄心に、絶縁棒を介して3相星形結線の固定子コイルを巻線した固定子において、上記固定子の各相を互いに並列に結線された第1のコイルと第

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2のコイルで構成し、上記絶縁枠の一方の面に上記第1、第2のコイル間の渡り線を預ける3個の電源線用端子を設けた固定子も提供する。そして、上記の固定子において、絶縁枠は、第1、第2のコイル間の渡り線を預ける電源線用端子側に、上記第1のコイルの巻き始め線と上記第2のコイルの巻き終わり線とを接続する中性線用端子を設けるのがよく、さらに、絶縁枠は、第1、第2のコイル間の渡り線を預ける電源線用端子と反対側の面に、各コイル間の電源線の渡り線をそれぞれ接触することなく渡らせるガイド部を設けるとさらによい。

【0006】この発明は上記のように構成することにより、その固定子コイルの並列結線方法においては、各相の電源線のコイル巻線後の線処理を省略することができる。また、上記のような並列結線方法で結線された固定子は、絶縁枠の一方の面に電源線用端子と中性線用端子とを設けることにより、結線の自動化を容易にするとともに、上記の各端子と反対側の面に各電源線の渡り線のガイド部を設けることにより、小さいスペースを有効に利用することができ、従来の並列結線で必要とされていた回路基板等を必要とせず、固定子の生産コスト引き下げが可能になる。

【0007】

【発明の実施の形態】以下、この発明の実施形態を図面に基いて具体的に説明する。図1は、この発明の一実施形態を示す結線図、図2は、図1を簡略化した模式的結線図、図3乃至図6は、コイルを巻線された固定子を示すもので、図3は、その平面図、図4は、その背面図、図5は、一部を図3のA-A断面で示した側断面図、図6は、その電源線の渡り線を示す要部側面図である。なお、これらの図において図1に対応する部分には同一の符号を付して示し、その説明は省略する。この固定子10は、図3～図5に示すように、内周部に中心から60度間隔に配置された6極の磁極歯12a、12b、12c、12d、12e、12f（任意のものを示すときは「磁極歯12」という）を有する固定子鉄心11と、この固定子鉄心11の各巻線スロット13a～13fの内面を覆い、一端面に3個の単連端子14a、14b、14cと1個の3連端子14dを突設し、他端面の外周部にそれぞれ渡り線のガイド部としての3条のガイド溝14e、14f、14gを形成した絶縁枠14とからなる。

【0008】このような構成からなる固定子10の単連端子14a、14b、14c側の相隣る磁極歯12a、12b、12cに、例えばノズル直巻き巻線機により同時に巻線した3相の第1のコイルU1、V1、W1の各リード線u、v、wを図3に示す単連端子14a、14b、14cのスリットにそれぞれ預けた後、切断することなく図4に示す反対側の面へ導き、それぞれの相対向する磁極歯への渡り線を外周部のガイド溝14e、14

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f、14gにそれぞれ沿って相対向する巻線スロット13d、13e、13fへ渡し、磁極歯12d、12e、12fに連続して巻線を行って第2のコイルU2、V2、W2を形成する。巻線後、図3及び図4に示すように、第1のコイルU1、V1、W1の巻き始めの中性線1u、1v、1wと第2のコイルU2、V2、W2の巻き終わりの中性線2u、2v、2wを後述する線処理ロボット等を用いて3連端子（または6連端子）14dのスリットへ任意の2本（または1本）ずつ預け、絶縁枠14の同一面に形成した3個の単連端子14a、14b、14cへU相、V相、W相の各電源端子を接続するとともに、1個の3連端子14dに正接端子（図示しない）を挿入することにより、すべての中性線1u、1v、1w、2u、2v、2wが接続されて中性点が形成されるようにする。

【0009】図1及び図2は、上記の固定子の結線図を示すものである。この結線図から分かるように、この実施形態では、従来はU相、V相、W相の各電源線から巻き始めていたコイル巻線をそれぞれ中性線から巻き始めるようにし、相対向する第1、第2のコイルU1、U2；V1、V2；W1、W2の渡り線を絶縁枠に設けた3個の単連端子に仲介させ、それぞれの単連端子にU相、V相、W相の電源を接続することにより、巻線後の各電源線の線処理を省略することができる。また、同時に巻線された第1のコイルU1、V1、W1のリード線を電源線接続用端子のスリットに預けた後、反対側の面へ導き、中性線と分離して電源線の渡りを行うようにしたので、小さなスペース内で各電源線の接触が防止され、中性線の接続と電源線の接続を回路基板等を用いることなく固定子の一方の面だけで行うことができ、絶縁枠の構成が簡単になって既成のものを使用することが可能になるとともに結線の自動化が容易になる。なお、絶縁枠の端子側にスペースがある場合には、電源線の渡り線を反対側へ導くことは必ずしも必要とするものではない。

【0010】図7は、前述の線処理ロボットの概略を示す正面図、図8は、その要部のみを示す平面図である。この線処理ロボット20は、左右、前後、上下及び旋回自在で各コイルのリード線30を把持及び釈放可能なハンド21と、ハンド21に把持されたリード線30を各端子例えば3連端子14dのスリットに押し込むワイヤプッシャー22と、押し込まれたリード線の余り線を切断するニッパ23と、これらにより各リード線を各端子のスリットに預けるときの案内をする線預けガイド24（図8）とを有している。このような構成で、固定子10を予め定められた線処理位置にセットし、線預けガイド24を図8に仮想線で示す位置から実線で示す位置に前進させるとともに、ハンド21が処理しようとするリード線、例えば巻き始めの中性線1u、1v、1wと巻き終わりの中性線2u、2v、2wをそれぞれ把持する。次

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に、線処理ロボット20を動作させて各リード線を預けようとする端子。例えば3連端子14dまで搬送し、ワイヤブッシャー22によりそれぞれ任意の2本ずつを3個のスリットへそれぞれ押し込み、余り線をニッパ23により切断する。

【0011】以上の実施形態においては3層6極の固定子の場合について説明したが、図9は、この発明を3相9極の固定子に実施した他の実施形態を示す結線図である。なお、この図9においては図を分かりやすくするためにU相のコイルのみを図示しているが、実際にはその他にV相及びW相の2組（全部で3組）の同様に結線されたコイルが存在する。この固定子40は、内周部に中心から40度間隔に配置された9極の磁極歯42a、42b、42c、42d、42e、42f、42g、42h、42iを有する固定鉄芯41と、同一面側に前実施形態と同様の3個の単連端子（図9ではそのうちの1個の端子44aのみを示す）と1個の多連端子を有する絶縁棒（いずれも図示しない）を有している。そして、上記の磁極歯42a、42d、42gにそれぞれU相の第1、第2、第3のコイルU1、U2、U3を、磁極歯42b、42e、42hにそれぞれV相の第1、第2、第3のコイルV1、V2、V3を、磁極歯42c、42f、42iにそれぞれW相の第1、第2、第3のコイルW1、W2、W3をそれぞれ巻線して、各相のコイルを並列に接続している。

【0012】各コイルの巻線に際しては、前実施形態と同様に、磁極歯42a、42b、42cに同時に3相の第1のコイルU1、V1、W1をいずれも中性線から巻き始める。以後はU相のみについて説明するが、第1のコイルU1を所定のターン数巻線した後、巻き終わり線を巻き始めの中性線1uと反対側の面を時計方向に渡らせて中性線1u側に設けた単連端子44aのスリットを跨がせ、磁極歯42dに第2のコイルU2を巻線し、その端末線2uを中性線側へ所定の長さ引き出して切断する。次いで、上記の単連端子44aのスリットへ新たなワイヤからなる第3のコイルの巻き始め線3uを預けた後、端子面と反対側の面を時計方向に渡らせて磁極歯42gに第3のコイルU3を所定のターン数巻線し、その巻き終わりの端末線3u'を中性線側へ所定の長さ引き出して切断する。

【0013】同様に、V相、W相の第1のコイルV1、W1の巻き終わり線を、図示しない図1と同様の第2、第3の単連端子のスリットを跨いで磁極歯42d、42fにそれぞれ第2のコイルV2、W2を巻線し、その巻き終わりの端末線をそれぞれ所定の長さを引き出して切断する。さらに、新たなワイヤからなる第3のコイルV3、W3の巻き始め線を第2、第3の単連端子に預けた後、磁極歯42h、42iにそれぞれV相、W相の第3のコイルV3、W3を巻線し巻線後の端末線を所定の長さ引き出して切断する。最後に、第1、第2、第3の単

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連端子にU相、V相、W相の各電源端子を接続するとともに、上記の単連端子と同一面側に設けた多連端子に第1のコイルU1、V1、W1の巻き始め線と第2、第3のコイルU2、V2、U3、W3の巻き終わり線へ複数本ずつ預け、上記多連端子に圧接端子を挿入することにより、すべての中性線を接続する。したがって、この実施形態では第3のコイルU3、V3、W3だけは電源線から巻き始めることになる。なお、3相12極の固定子の場合には、前述の3相6極の巻線パターンを30度回転方向にずらして重ね合わせ、U相、V相、W相それぞれ2箇所ずつ電源端子を設け、これらの2箇所ずつの電源端子を電源線接続に短絡することにより4コイルを並列接続することが可能になる。

【0014】

【発明の効果】以上述べたように、この発明によれば、以下に記載する効果を奏する。請求項1記載の固定子コイルの並列結線方法によれば、固定子の各磁極歯の相対向する一方の磁極歯に巻線する第1のコイルをそれぞれ中性線から巻き始め、他方の磁極歯に巻線する第2のコイルへの渡り線を3相の電源線にそれぞれ接続したので、電源線の巻線後の線処理を省くことができ、少ないリード線の処理で並列結線を行うことが可能になる。請求項2記載の固定子コイルの並列結線方法によれば、第1のコイルから第2のコイルへの渡り線を絶縁棒の端子を介してそれぞれ3相の電源線に接続するようにしたので、電源線への接続を大幅に簡略化することができる。請求項3記載の固定子コイルの並列結線方法によれば、第1、第2のコイル間の電源線の渡り線を端子と反対側のガイドに沿って渡らせるようにしたので、各中性線と錯綜して電源線同士が互いに接触するおそれがなくなる。

【0015】請求項4記載の固定子によれば、絶縁棒の一方の面に第1、第2のコイル間の渡り線を預ける電源線用端子を設けたので、これらの電源線用端子に3相の電源線をワンタッチで接続することが可能になる。請求項5記載の固定子によれば、絶縁棒の電源線用端子と同一面に中性線用端子を設けたので各リード線の接続は固定子の一方の面側だけでよく、線処理ロボット等による線処理の自動化が容易になる。請求項6記載の固定子によれば、第1、第2のコイル間の電源線を絶縁棒の端子と反対側の面に設けたガイド部を渡らせるようにしたので、電源線間同士が接触するおそれなく、回路基板等を必要とせず固定子の小型化と生産コストの低減が可能になる。

【図面の簡単な説明】

【図1】この発明の一実施形態を示す結線図である。

【図2】図1を簡略化した模式的結線図である。

【図3】この発明による固定子を固定子コイルと共に示す平面図である。

【図4】同じくその背面図である。

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【図5】同じくその一部を図3のA-A断面で示した側断面図である。

【図6】同じくその巻線線の渡り線を示す要部側面図である。

【図7】この発明の並列結線に用いられる線処理ロボットの概略を示す正面図である。

【図8】同じくその要部のみを示す平面図である。

【図9】この発明の他の実施形態のU相のみを示す結線図である。

【図10】従来の固定子コイルの並列結線の結線図である。

【符号の説明】

1u, 1v, 1w: 第1のコイルの巻き始め線(中性線)

2u, 2v, 2w: 第2のコイルの巻き終わり線(中性線)

\* 3u: 第3のコイルの巻き始め線

3u': 第3のコイルの巻き終わり線

10, 40: 固定子

11, 41: 固定子鉄心

12, 12a~12f, 42a~42i: 磁極歯

13a~13f: 巻線スロット

14: 絶縁枠

14a~14c, 44a: 単連端子

14d: 3

連端子

14e~14g: ガイド溝

20: 線処理ロボット

21: ハンド

22: ワイヤブッシャー

23: ニップ

30: リード線

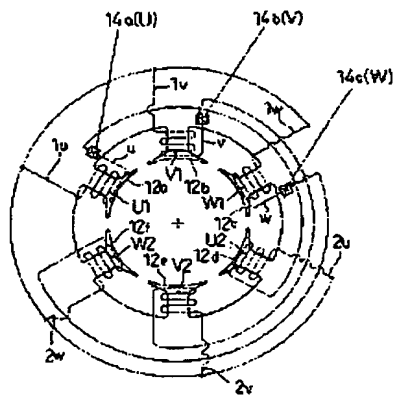
U1, V1, W1: 第1のコイル

U2, V2, W2: 第2のコイル

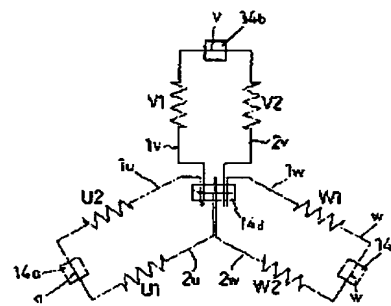
U3, V3, W3: 第3のコイル

\*

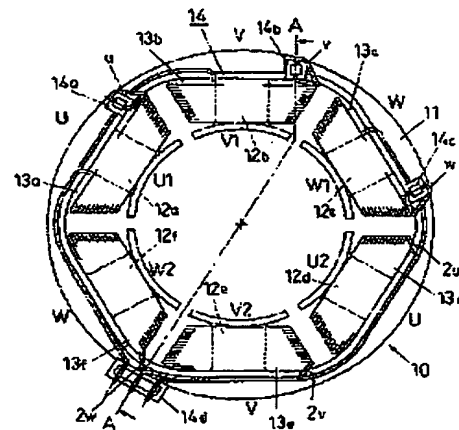
【図1】



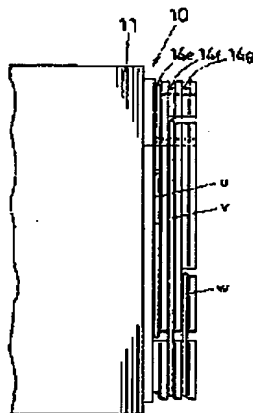
【図2】



【図3】



【図6】

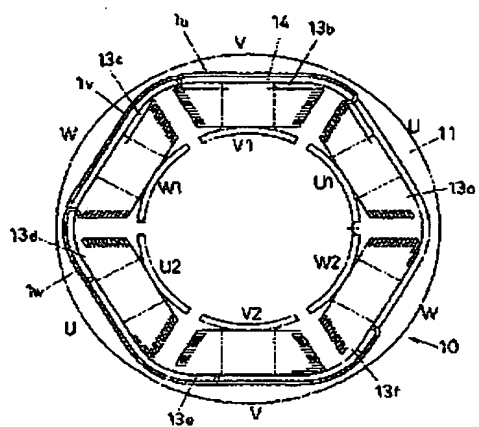




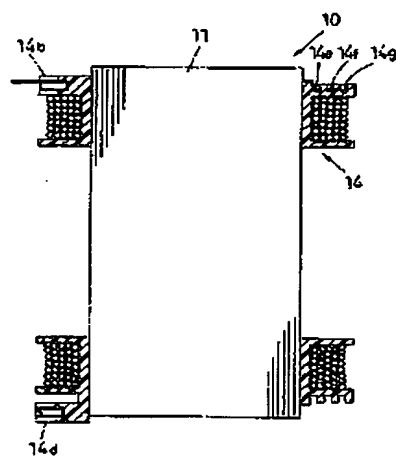
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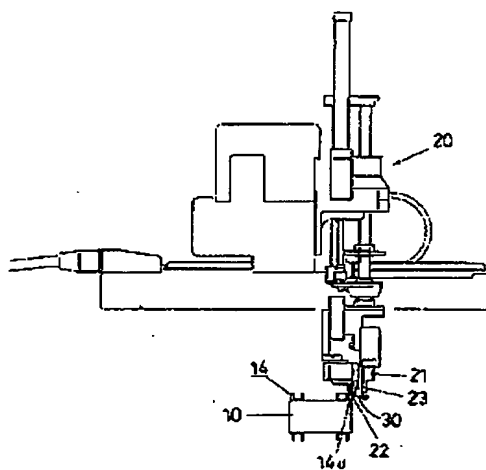
【図4】



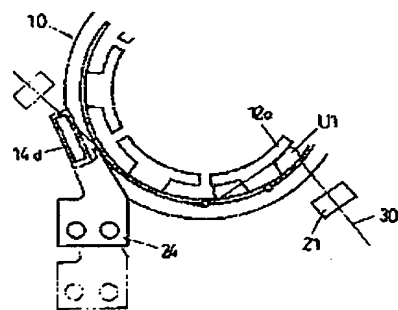
【図5】



【図7】

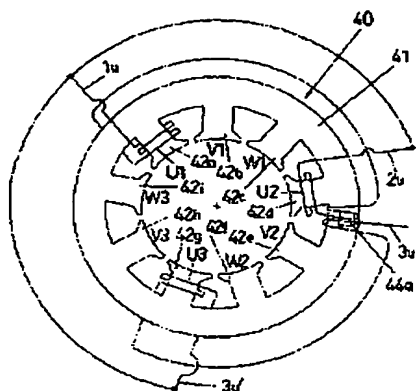


【図8】

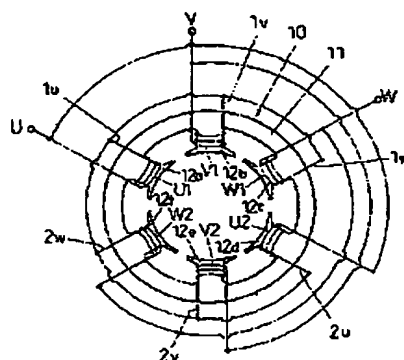


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【图9】



【図 10】



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```
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                  CC11 CD02 CE01 EE01 EE13
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5H604 AA05 AA08 BB01 BB08 BB14
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                  QA01 QA08 QB14
5H615 AA01 BB01 BB05 BB14 BB16
                  PP01 PP14 PP16 SS15 TT03
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